(e) recovering from said solvent a solid carbon product comprising a fullerene, said solid carbon product being substantially fullerene.

99. A solid carbon product prepared by the process comprising:

(a) vaporizing elemental carbon in the presence of an inert quenching gas under conditions effective to provide a sooty carbon product comprising fullerene molecules;

(b) depositing the sooty carbon product on a collecting substrate;

(c) removing the sooty carbon product from the collecting substrate;

(d) subliming the carbon product comprising fullerene from the sooty carbon product; and

(e) condensing the sublimed carbon product and recovering therefrom a solid carbon product substantially comprising a fullerene.

100. The solid carbon product of Claim 98 or 99 further comprising:

(f) purifying the carbon product of step (e).

101. The solid carbon product of Claim 98 or 99 wherein elemental carbon is graphite, amorphous carbon or glassy carbon.

102. The solid product of Claim 98 or 99 wherein the inert quenching gas is a noble gas.

103. The solid product of Claim 98 or 99 wherein the carbon is vaporized in a reaction vessel which has been evacuated prior to the carbon vaporization step.--

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REMARKS

The Office Action has provisionally rejected Claims 46-69, 71-78 and 82-88 under 35 U.S.C. §101 as allegedly defining the same invention as that of Claim 76, 82-90, 92-103,

111-114, 119, 122-123, 137, 165-170 and 173 of copending application Serial No. 07/580.246. In addition, Claims 45, 70 and 79-81 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as allegedly being unpatentable over Claims 45-75, 77, 79-81, 91, 104-110, 115-118, 120-121, 124-136, 136-164, 171-172 and 174-180 of copending application Serial No. 07/580,246. Moreover, Claims 45-47, 70, 75, 77, 79-81 are rejected under 35 U.S.C. §112, first paragraph, as allegedly being non-enabling. Moreover, the specification is objected to and Claim 53, 62 and 66-88 are rejected under 35 U.S.C. §112, first paragraph, as allegedly failing to contain a written description of the invention. In addition, Claims 47, 63-67, 76-78 and 88 are rejected under 35 U.S.C. §112, second paragraph, as allegedly failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Further, Claims 45-88 are rejected under 35 U.S.C. §101 for allegedly defining a natural product as defined in an article by Buseck, et al. in Science 1992, 257, 215-217 ("Buseck, et al."). Moreover, Claim 48 is rejected under 35 U.S.C. §102(b) or in the alternative under 35 U.S.C. §103 as defining subject matter which is allegedly anticipated by or, in the alternative, rendered obvious by the teachings in U.S. Patent No. 3,931,704 to Tominaga, et al. ("Tominaga, et al."). Furthermore, the Office Action has rejected Claims 45-51, 53-56, 58-59, and 62-68 under 35 U.S.C. §102(b) or, in the alternative, under 35 U.S.C. §103 as defining subject matter which is allegedly rendered obvious by the teachings in Kroto, et al. in Nature 1985, 318, 162-163 ("Kroto, et al.") In addition, Claims 45-51, 53-56, 58-59 and 62-88 are rejected under 35 U.S.C. §102(b) as defining subject matter which is allegedly anticipated by Kratschmer, et al. in Surface Science

1985, 156, 814-821 ("Kratschmer, et al. I"). Finally, Claims 45, 48-50, 53-55, 62-67, 70-78 84-85 and 88 are rejected under 35 U.S.C. §102(b) as defining subject matter which is allegedly anticipated by the teachings in an article by Kratschmer, et al. in Chemical Physics Letter, 1990, 170, 167-170 ("Kratschmer, et al. II").

In response thereto, applicants have canceled claims and added claims and are submitted two Declarations by Harry Kroto, which, when considered with the comments hereinbelow are deemed to place the presence case in condition for allowance.

Applicants have canceled without prejudice Claims 45-88. They have not, however, abandoned the subject matter recited therein and reserve the right to file a continuation application directed thereto.

Claims 89-103 have been added to the application; they are directed to, inter alia, isolated fullerene products which are present in sufficient quantities to be visible, i.e., in macroscopic amounts. A discussion regarding support for the concept "macroscopic" is discussed infra in response to a rejection under 35 U.S.C. §112, first paragraph.

The application provides ample support for fullerenes. Support permeates the specification. More specifically, the specification describes three species C_{60}, C_{70} and C_{240}. Each of these molecules is a fullerene. C_{60} is fullerene-60, C_{70} is fullerene-70 and C_{240} is fullerene-240. The application refers to "new form of carbon", (Page 1, Line 6), an allotrope of carbon (e.g., see original Claim 27, and Page 16, Line 26 of the instant application), compounds made solely of carbon atoms soluble in non-polar organic solvents (see, e.g., Page 11, Lines 8-11 of the instant specification), all of which are description and characterizations of and are synonymous with fullerenes. The whole thrust of the

application is directed to a new form of carbon. In fact, the application is so titled. All of these delineations are different descriptions of and connote only one subject matter--fullerenes.

Case law has held that compliance with the description requirement of 35 U.S.C. §112, first paragraph, requires the specification to reasonably convey to the skilled artisan that the inventor had possession at the time of the filing of the application of the claimed subject matter. Fiers v. Revel, 984 F.2d 1164, 25 USPQ 2d 1601 (Fed. Cir. 1993). As evidence thereof, applicants are enclosing herewith a Declaration of Harold W. Kroto, a renowned expert in the field of fullerenes, that was submitted in copending application USSN 08/236,933 (hereinafter "Kroto Declaration I"). Attention is directed to Paragraph 15 of Kroto Declaration I wherein he states:

> In my professional judgment, the above identified application adequately teaches to the skilled artisan how to make macroscopic amounts of fullerene including C_{60} and C_{70}; furthermore, there is ample evidence in the application that Huffman and Kratschmer had in their possession macroscopic amounts of these products.

Thus, Kroto, who is an skilled artisan in the field, understood when he read the specification that the inventors had in their possession fullerenes at the time of the filing of the application.

Even the Office Action characterizes the product of the invention as fullerenes. Attention is directed to Page 6 of the Office Action, wherein the products of the specification are defined in terms of fullerenes:

> To illustrate, the literal language of the original disclosure supports the production of fullerenes in quantities sufficient to produce coatings that are 2 microns thick. (Emphasis added).

Although the Office Action may disagree with applicants that the specification describes macroscopic amounts of product being formed, an issue which will be discussed infra, the Office Action defines the products produced in the specification as fullerenes, indicating that even the United States Patent and Trademark Office agrees that the applicants had "fullerenes" in their possession at the time of the filing of the application and that the application has ample support under 35 U.S.C. §112, first paragraph, for said term.

The other terms in the claims, "an allotrope of carbon which is neither graphite or diamond" is also supported in the specification. By identifying the product of the application as a "new form of carbon", or "allotrope of carbon", and describing it as being soluble in non-polar solvents, it conjures to the skilled artisan a form of carbon that neither graphite nor diamond, (for those are old in the art and neither is soluble in these solvents) i.e., fullerenes. Thus, there is ample support in the specification for this language.

The other terms and characteristics of fullerenes are also described in the application, e.g., solubility characteristics (Page 5, Line 24 to Page 6, Line 6 of the instant specification), "caged molecules consisting solely of carbon atoms". (Page 11, Lines 8-11 of the instant specification). Thus, adequate support is found in the application for fullerene and these various characterizations.

With respect to this term "macroscopic, there is also ample support in the specification, and this issue will be discussed infra with respect to the 35 U.S.C. §112, first paragraph rejection.

The claims further define that the fullerenes are isolated from the carbon soot formed from vaporized carbon

vapor. Support is found for this concept for example, on Page 5, Line 5 to Page 6, Line 6 and Example 1 of the instant specification.

More specific support for the claimed subject matter is shown in the following table:

CLAIM	SUPPORT
89	See discussion hereinabove and hereinbelow with respect to the terms "fullerenes" and "macroscopic amounts", respectively
90	Page 3, Line 27 to Page 7, Line 25, Example 1, and discussion of "macroscopic amounts"
91	Page 7, Lines 10-25, and Example 1
92	Page 3, Line 27 to Page 7, Line 25, Example 1 and discussion of "macroscopic amounts" and "fullerene"
93	Page 1, Lines 5-8; Page 5, Line 20 to Page 6, Line 6; claim 27; for "macroscopic", see discussion infra
94	Page 1, Lines 5-8; Page 5, Line 20 to Page 6; Line 6, Claim 27
95	Page 6, Lines 6-22; Page 7, Lines 19-25; Page 13, Line 32 to Page 14, Line 14
96	Page 6, Lines 6-22; Page 7, Lines 19-25; Page 13, Line 32 to Page 14, Line 14
97	Page 1, Lines 5-8; Page 3, Lines 27-35; Page 5, Line 20 to Page 6, Line 6; Claim 27, for "macroscopic", see discussion,
98	Page 3, Line 26 to Page 7, Line 25 and discussion of fullerene
99	Page 3, Line 26 to Page 7, Line 25 and discussion of fullerene
100	Page 13, Line 32 to Page 14, Line 29

101	Page 4, Lines 1-11
102	Page 4, Lines 11-15
103	Page 3, Lines 26-36, Example 1

Thus, there is adequate support for the added claims to the specification; no new matter has been added.

Pursuant to the provisional rejection of Claims 46-69, 71-78, and 82-88 under 35 U.S.C. §101, the Office Action alleges that the subject matter therein is claiming the same and identical invention as that recited in Claims 76, 82-90, 92-103, 111-114, 119, 122-123, 137, 165-170 and 173 of the copending '246 application.

The rejected claims of the present application have been canceled, thus this rejection is rendered moot with respect to those claims. Moreover, the rejection is not applicable to the added claims for the following reasons.

In considering the question of double patenting under 35 U.S.C. §101, only the claims are compared. The objective test for same invention type double patenting is whether one of the conflicting claims (if two claims are asserted to be defining the same invention) could be literally infringed without literally infringing the other; if it could be, then the claims do not define identically the same invention. In re Vogel, 422 F.2d 438, 441, 164 USPQ 619, 621-622 (CCPA 1970).

The specified claims of the '246 application recite products containing macroscopic amounts of C_{60} and/or C_{70}. On the other hand, the claimed invention of the instant application, as amended, is generally directed to isolated fullerenes in macroscopic amounts. Thus, the claims of the instant invention could be literally infringed without infringing the claims of the '246 application.

Furthermore, neither the present application nor the '246 application have in fact been patented. Thus, it is premature to reject the present application on those grounds.

Thus, for the reasons provided, the provisional rejection of the claimed subject matter under 35 U.S.C. §101 is obviated, and withdrawal thereof is respectfully requested.

Pursuant to the rejection of Claims 45, 70 and 79-81 under the judicially created doctrine of obviousness-type double patenting the Office Action cites Claims 138-164, 171-172 and 177-180 of the '246 application.

According to the Office Action, the conflicting claims are not patentably distinct from each other because the product of the claim of copending '246 differ only in that they are described by a slightly different method of making.

By the explanation in the Office Action, it would appear that the rejection is directed to the product by process claims in the present application vis 'a vis the product by process clams in the '246 application. Yet, with respect to this rejection there are claims identified in the '246 application as well as in the present application which are not product by process claims. Clarification thereof is respectfully requested.

Since the rejected claims have been canceled, this rejection has been rendered moot with respect to those claims. But, assuming that the rejection is directed to the added product-by process claims, applicants respectfully submit that the Office Action has not made out a prima facie case of obviousness-type double patenting.

In considering the question of obviousness-type double patenting, only the claims of the patent and the application are compared. Quad Environmental Technologies Corp. v Union Sanitary District, 946 F.2d 870, 873, 20 USPQ2d

1392, 1394 (Fed. Cir. 1991). The question to consider is whether any claims in the application define merely an obvious variation of an invention disclosed and claimed in the patent. In re Vogel, 442 F.2d 438, 441, 164 USPQ 619, 622 (CCPA 1970).

However, in rejecting the claims of the present application the Office Action did not apply such a test. It describes the differences as "a slightly different method of making" and that the two products are "substantially similar". This, however, is not the proper test, since slight variations may be enough to impart patentability. The proper test is whether the products of the conflicting claims define obvious variations of each other. Vogel. Thus, the Office Action failed to apply the proper standard.

Moreover, this double-patenting rejection is premature, especially since neither application has been patented.

Therefore, for the reasons given, the obvious-type double patenting rejection is obviated, and withdrawal thereof is respectfully requested.

Pursuant to the objections of the specification under 35 U.S.C. §112, first paragraph, the Office Action alleges that the specification is only enabling for the carbon source in the vaporization step to be elemental carbon. Although applicants disagree, inasmuch as the appropriate claims recite that the carbon source for the vaporization step is elemental carbon, the objection of the specification under 35 U.S.C. §112, first paragraph, is obviated. Withdrawal thereof is respectfully requested.

Pursuant to another objection to the specification under 35 U.S.C. §112, first paragraph, the Office Action alleges that there is no descriptive support for the term "macroscopic". Applicants disagree.

There is adequate support in the application for the term "macroscopic". Literal support is not necessary for compliance with the description requirement as long as the application conveys the concept to the skilled artisan. This the application adequately does. More specifically, support for this term and concept permeates the specification. For example, attention is directed to Page 7, Lines 10-25, Page 8, Lines 3-16 and to Example 1 of the instant specification wherein the color of the product produced therefrom is indicated. Obviously, one cannot determine color unless it is present in amounts that can be seen with the naked eye, i.e., macroscopic amounts. If less than macroscopic amounts were produced, no color would be seen even if the samples were dissolved in benzene. See, Curl, et al, Scientific American 1991, 54-55. Furthermore, attention is directed to Figure 2, of the instant specification wherein an X-ray diffraction pattern is provided of a product produced in accordance with the present invention. As the skilled artisan is well aware, macroscopic quantities had to be available to generate a X-ray diffraction of the product. In addition, attention is directed to Page 11, Line 30 of the instant specification wherein it is indicated that the IR is taken of an approximately two micrometer thick C_{60} coating on a silicon substrate. Especially since C_{60} is colored, it is obvious that this coating had to seen with the naked eye. Furthermore, the application makes additional references to characteristics of the product that can only be discernible if the material is present in macroscopic amounts. For example, the application describes that the product is a powder (Page 7, Line 25). Furthermore, the application describes that the product produced by sublimation of the carbon soot can range from a uniform film to a coating, and the color is brown to gray

depending on the thickness of the coat formed, while the product obtained from extraction is a dark brown to black crystalline material. Obviously, these characteristics can be differentiated if the product was produced in amounts that can be seen with the human eye.

It is important to keep in mind that which was not stated; if the products produced can only be detected through instrumentation, such representation would have been made in the application and evidence supporting same such as election micrographs would have been provided. In fact, the application acknowledges that C_{240} was observed from a scanning tunneling microscopic image. The fact that such statements were not made and such evidence was not provided with respect to C_{60} and C_{70}, for example, is further evidence that these products were formed in macroscopic amounts.

Case law has held that the description requirement is meant if the application conveys to the skilled artisan that the applicants has possession of the invention at the time of the filing. Vas Cath Inc. v. Mahurkar, 935 F.2d 1535, 19 USPQ2d 1111 (Fed. Cir. 1995). Attention is directed to Kroto Declaration I, Paragraphs 14 and 15 in which he attests that the application describes the method for making macroscopic amounts of fullerenes and that the inventors had in their possession at the time of the filing of the application macroscopic amounts of fullerenes. Kroto, who is a skilled artisan in the field, understood from reading the application that the applicants had made macroscopic amounts of fullerenes and had it in their possession at the time of the filing of the application, providing further evidence that there is adequate support in the specification for the term "macroscopic".

The present situation is not unlike that in In re Smythe, 480 F.2d 1376, 178 USPQ 279 (CCPA 1973). In Smythe, the invention related to a "continuous automatic analysis system where discrete liquid samples...are successfully introduced into an apparatus as a continuous stream, the individual samples being separated by a segmentizing medium." Both the specification and original claims identified this medium as "air or other gas which is inert to the liquid." The applicant later added claims that described the medium as "inert fluid". The United states Patent and Trademark Office rejected the added claims on the basis of the description requirement, but the Smythe Court reversed, stating that the use of the term "inert fluid" would naturally occur to the skilled artisan reading the description of the use of air or other gas as a segmenting medium to separate the liquid samples. Id at 1384, 178 USPQ at 285. The court provided its rationale as follows:

> ....[W]hereas the broader concept of using "inert fluid" would naturally occur to one skilled in the art from reading appellants' description of the use and functions of the segmenting medium specifically described, we see no basis for denying appellants the claims which recite the segmenting medium broadly as "an inert fluid". The alternative places upon patent applicants, the Patent Office, and the public the undue burden of listing, in the case of applicants, reading and examining, in the case of the Patent Office, and printing and storing, in the case of the public, descriptions of the very many structural or functional equivalents of disclosed elements or steps which are already stored in the minds of those skilled in the arts, ready for instant recall upon

> reading the descriptions of specific elements of steps.
>
> We are not saying that the disclosure of 'air or other gas which is inert to the liquid' sample by itself is a description of the use of all 'inert fluid' media. Rather, it is the description of the properties and functions of the 'air or other gas' segmentizing medium described in appellants' specification which would suggest to a person skilled in the art that appellants' invention includes the use of 'inert fluid' broadly...
>
> A hypothetical situation may make our point clear. If the original specification of a patent application on the scales of justice disclosed only a 1-pound 'lead weight' as a counterbalance to determine the weight of a pound of flesh, we do not believe the applicant should be prevented, by the so-called 'description requirement' of the first paragraph of §112, or the prohibition against new matter of §132, from later claiming the counterbalance as a 'metal weight' or simply as a 1-pound 'weight', although both 'metal weight' and 'weight' would indeed be progressively broader than 'lead weight', including even such an undisclosed, but obviously art-recognized equivalent, 'weight' as a pound of feathers. The broader claim language would be permitted because the description of the use and function of the lead weight as a scale counterbalance in the whole disclosure would immediately convey to any person skilled in the scale art the knowledge that the applicant invented a scale with a 1-pound counterbalance weight, regardless of its composition. (Emphasis in original)

The Smythe Court held that the description in the application suggested to the skilled artisan the broader term.

Similarly, as in Smythe, the present application supports the concept "macroscopic amounts of fullerenes". Based upon all of the evidence referred to hereinabove, the concept of macroscopic amounts would naturally occur to the skilled artisan as testified by Kroto in Kroto Declaration I, Paragraph 15.

According to the Office Action, the literal language of the original disclosure supports the production of fullerene in quantities sufficient to produce coatings that are 2 microns thick. Although the specification supports the production of fullerenes in macroscopic amounts, even if the allegation in the Office Action were correct, this is an admission by the United States Patent and Trademark Office that significant amounts of fullerene were prepared. Moreover, assuming that allegation were correct, much more fullerene could be prepared, including tonnage quantities, if the process were repeated again and again. Thus, even with the Office Action's assumptions, assuming sufficient amount of carbon source were utilized, macroscopic quantities of fullerenes could be produced.

The Office Action cites In re Barker, 194 USPQ 470 (CCPA 1977); according to the Office Action, Barker contained drawings that showed contemplation of an embodiment of making prefabricated panels of wooden shingles, where the backing board had lengths of four or eight feet with a repetitive series of eight or 16 shingles per backing board. The applicants wished to amend the claims to recite a backing board having a length at least as great as the aggregate width of at least six shingles, but the Barker court held that the specification did not support such an amendment. However, the present situation is quite distinct from that of In re Barker. In Barker, there was nothing in the specification which

applicants could point to which connoted the language that they wish to add to the claims. It was clear that applicants contemplated backing boards of four and eight foot lengths having a repetitive series of eight or 16 shingles thereon; and that there was no support for language that applicants wished to add. This is unlike the present situation in which there are plenty of passages, which taken as a whole connote and support that applicants had macroscopic amounts of fullerenes at the time of filing. In addition, unlike the situation in Barker, applicants have a declaration from a skilled artisan that attests to the fact that the application supports macroscopic amounts of fullerenes.

Therefore, for the reasons provided the objection to the specification on these grounds is obviated, and withdrawal thereof is respectfully requested.

The Office Action has rejected Claims 47, 63-67, 76-78, 81 and 88 under 35 U.S.C. §112, second paragraph, but inasmuch as these claims have been canceled without prejudice, these rejections have been rendered moot.

In support of the rejection of the claimed invention under 35 U.S.C. §101, the Office Action cites Buseck, et al. alleging that the article discloses that fullerenes were found in shungite, and as such, is an article of nature.

Applicants disagree.

The present invention is a new and useful manufacture or composition of matter, as defined under 35 U.S.C. §101. The terms "manufacture" and "composition of matter" are broadly construed so that a wide scope of inventions are encompassed by the statute. Diamond v. Chakrabarty, 447 U.S. 303, 308, 206 USPQ 193, 197, (1980). The term "manufacture" in 35 U.S.C. §101 has been construed to mean "the production of articles by use from raw materials prepared by giving to these materials

new forms, qualities, properties or combinations whether by hand-labor or by machinery" while "composition of matter" has been construed to include" all compositions of two or more substances, and ....all composite articles, whether they be the results of chemical union or mechanical mixture or whether they be gases, fluids, powders, or solids. "Id., 444 US at 308, 206 USPQ at 196-197.

Although the courts have placed limits on 35 U.S.C. §101, and have held that the laws of nature, physical phenomena and abstract ideas are not patentable, Id., 447 U.S. at 309, 206 USPQ at 196, contrary to the allegations by the Office Action, the claimed subject matter does not fit within any of these non-statutory categories. The claimed subject matter, fullerenes, was prepared in the laboratory from raw materials, imparting new qualities, properties or forms thereto relative to the raw materials. In addition, the fullerenes are composite articles formed by physical and chemical degradation and union. But, more importantly, even if one accepts the allegations in the Buseck, et al. article, C_{60} and C_{70} are only found in trace amounts, in parts per billion, as opposed to the claimed subject matter, wherein the fullerenes are being claimed to be present in macroscopic amounts.

Apparently, the Office Action failed to consider the patent claim as a whole--a requirement in the analysis under 35 U.S.C. §101. Parker v. Flook, 437 U.S. 584, 594, 198 USPQ 193, 198, footnote 16, (1978). Just because the claims contain the terms fullerenes this does not necessarily mean that the claimed subject is not patentable under 35 U.S.C. §101. The other words in the various claims, e.g., "macroscopic amounts," "substantially pure," etc. must also be considered in any 35 U.S.C. §101 analysis. These terms add significant meaning to

the claims and separates the claimed subject matter from that which is described in the cited article.

Taking into account these considerations, it is apparent that the conclusions of the Office Action regarding the claimed subject matter are incorrect.

It is axiomatic that patent protection has been provided for new and useful compositions of matter, even when the underlying compound is naturally produced in trace amounts.[1] As the court stated in In re Bergy, 596 F.2d 952, 201 USPQ 352 (CCPA 1979), vacated, sub. nom; Diamond v. Chakrabarty, 444 U.S. 1028, aff'd 497 U.S. 303, 206 USPQ 193 (1980).;

> ....The law has long and unhesitatingly granted patent protection to new, useful and unobvious chemical compounds and compounds and compositions in which category are to be found such important products of microbiological process as vitamin B-12 and adrenalin and countless other pharmaceuticals...

Id., 596 F.2d at 975, 201 USPQ at 373. In fact, The Court has cited Merck and Co. v. Chase Chemical Co, Merck and Co. v. Olin Mathieson Chemical Co. and Parke-Davis v. H.K. Mulford Co. with approval. In In re Kratz, 592 F.2d 1169, 201 USPQ 71 (CCPA 1979), the CCPA discussed the two Merck cases characterizing them in the following manner:

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[1]Patent protection has been granted and held valid by the courts to such naturally produced products as vitamin B-12(Merck Co. v Chase Chemical Co., 273 F Supp. 68, 155 USPQ 139 (D.N.J. 1967) and Merck and Co. v. Olin Mathieson Chemical Corp., 253 F.2d 156, 116 USPQ 484 (4th (1958)); aspirin (Kuehmsted v. Farbenfabriken of Elberfeld Co., 179 F. 701 (7th Cir 1910), cert. denied, 220 U.S. 622 (1911)); tetracycline (Chas Pfizer and Co. v. Barry-Martin Pharmacueticals, Inc., 241 F. Supp. 191, 145 USPQ 29 (S.D. Fla. 1965)); prostaglandin compounds PGE_2 and PGE_3 (In re Bergstrom, 427 F.2d 1394, 166 USPQ 256 (CCPA 1970)); adrenalin (Parke-Davis and Co. v. H.K. Mulford Co., 189 F. 95 (C.C.D.N.Y. 1911), modified, 196 F. 496 (2d Cir. 1912), and 1-arterenol (Sterling Drug v. Watson, 135 F. Supp. 173, 108 USPQ 37 (D.D.C. 1955)).

The patentees in these cases were the first to separate and purify vitamin B-12. Those of ordinary skill in the art knew that certain extracts of fiber were active in combating pernicious anemia. Those workers did not know what it was in the liver extracts that controlled the anemia nor did they have any understanding of the chemical nature of whatever that something in liver was. Although the patentees recovered the compound from a source containing a microorganism, fellow workers at Merck demonstrated that patentees' invention was the same compound as found in liver....

Nevertheless, in each of these cases, the invention recited in the claim was found to be novel since the claims did not cover any natural composition...

Id., 592 F.2d at 1174, 201 USPQ at 75.

In each of these earlier cases, the Court indicated that the patentees changed the form of that of the natural product, e.g., claims were directed to purer products or more active products than the natural products. The Courts considered various criteria; but those factors which most influenced the courts included the abundance and usefulness of the claimed product and the minute quantities of the product that was naturally produced. As stated by the Court of Appeals in Olin Mathieson, 253 F.2d at 164,

> The composition of the patent ('302) here have all of the novelty and utility required by the Act for patentability. They never existed before; there was nothing comparable to them. If we regard them as purification of the active principle in natural fermentates, the natural fermentates are quite useless, while the patented compositions are of great medical and commercial value. The step from complete uselessness to great and perfected utility is a long one. That step is no mere advance in the degree of purity of a known product. From the natural fermentates, which, for this purpose, were wholly useless and were not known to contain the desired activity in even the slightest degree, products of great therapeutic and commercial worth have been developed. The new products are not the same as the old but now are useful compositions entitled to the protection of the patent.

As was stated in the aspirin case, Kuehmsted v. Farbenfabriken of Elberfeld Co., 179 F. 701, 705 (7th Cir. 1910),

> Hoffmann has produced a medicine indisputably beneficial to mankind-something new in a useful art, such as our patent policy was intended to promote. Kraut and his contemporaries, on the other hand, had produced only, at best, a chemical compound in an impure state. And it makes no difference, so far as patentability is concerned, that the medicine thus produced is lifted out of a mass that contained, chemically, the compound; for, though the difference between Hoffmann and Kraut be one of purification only- strictly marking the line, however, where the one is therapeutically unavailable-patentability would follow. In the one case the mass is made to yield something to the useful arts; in the other case what is yielded is chiefly interesting as a fact in chemical learning.

Judge Learned Hand in Parke-Davis & Co. v. H.K. Mulford Co., 189 F. 95, 103, (C.C.D.N.Y. 1911), modified 196 F. 496 (2d Cir. 1912) stated the principle thusly:

> Nor is the patent only for a degree of purity, and therefore not for a new 'composition of matter.' As I have already shown, it does not include a salt, and no one had ever isolated a substance which was not in salt form, and which was anything like Takamine's. Indeed, Sadtler supposes it to exist as a natural salt, and that the base was an original production of Takamine's. That was a distinction not in degree, but in kind. But, even if it were merely an extracted product without change, there is no rule that such products are not patentable. Takamine was the first to make it available for any use by removing it from the other gland-tissue in which it was found, and while it is of course possible logically to call this a purification of the principle, it became for every practical purpose a new thing commercially and therapeutically. That was a good ground for a patent.

Under the rationale of these holdings, it is clear that the claimed subject matter is directed to patentable subject matter under 35 U.S.C. §101.

Macroscopic amounts of fullerene are not naturally found or produced in nature. Even if the allegation of Buseck,

et al. are correct, C_{60} is only present in infinitesimal amounts.[2] Even if the article is taken at face value, the cited article alleges that C_{60} and C_{70} are found in parts per billion. In these small amounts, the C_{60} and C_{70} reportedly found are in concentrations to small to be useful to the skilled artisan. Attention is directed to Kroto Declaration in the '246 application ("Kroto II Declaration") Paragraph 16, wherein Kroto so testifies. Thus, the teachings in the article do not put the public in possession thereof. On the other hand, macroscopic amounts of fullerenes, can only be produced by synthetic means. But, most importantly, this mass yields something that is quite useful to the arts. As Kroto stated in Paragraph 6 of the Kroto II Declaration:

> For the first time, scientists were able to produce and work with samples of fullerenes. They were able to confirm the theoretical prediction about fullerenes and continue to explore new properties of same. Their discovery spawned enormous scientific interest. As a consequence, innumerable investigations and studies relating to fullerenes were conducted, generating more than four thousand publications on the subject. In short, I cannot emphasize enough that their [Huffman's and Kratschmer's] discovery revolutionized the area of fullerenes.

Thus, it is apparent that macroscopic amounts of fullerenes have become for every practical purpose a new thing which is not the same as the old and which is entitled to patent protection.

It is to be noted that the present case is one step removed from the facts in these cases, in that the fullerenes, to which the claimed subject matter is directed, were not

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[2]Without the invention of Huffman and Kratschmer, even after the publication of these articles, the public would not be in possession of macroscopic amounts of C_{60} of C_{70}, for the C_{60} and C_{70} alleged to be found is present in infinitesimal amounts.

isolated from natural products by the inventors, but were synthesized. Inasmuch as these cases have held that those natural products isolated from natural sources were patentable it is even more compelling that the presently claimed synthesized subject matter is patentable.

The present situation is more akin to that of In re Seaborg, 328 F.2d 996, 140 USPQ 662 (CCPA 1964). In Seaborg, the inventors synthesized two isotopes of americium. The claims were directed to (a) element 95 and (b) the isotope of element 95 having the mass number 241. The claims were rejected under 35 U.S.C. §101, the United States Patent and Trademark Office alleging that element 95 was inherently produced in the operation of a reactor described in U.S. Patent No. 2,708,656 to Fermi, et al. Although nothing was detected[3], it was calculated that the maximum amount of americium 241 produced was 6.15×10^{-9} grams, which would have been distributed throughout forty tons of intensely radioactive reactor fuel. The Seaborg Court held that the claims were valid.

Similarly, since the amount of C_{60} and C_{70} that is alleged to be present in the samples disclosed in the articles are infinitesimal, the present claimed subject matter is therefore entitled to patent protection.

The rationale behind 35 U.S.C. §101 is clearly stated in Parker v. Flook, 437 U.S. 584, 198 USPQ 193 (1978):

> There is a very compelling reason for this rule. The reason is founded upon the proposition that in granting patent rights,

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[3]To be sure, it appears that there was nothing in the record to indicate that the element was detected. The same is true in the present case, since the office has not adequately proved that C_{60} and C_{70} are present in the rock and clay samples disclosed as the cited article.

> the public must not be deprived of any rights that it theretofore freely enjoyed.

Id., at 593, 198 USPQ at 198 Footnote 15, (quoting P. Rosenberg, Patent Law Fundamentals. §4 at 13 (1975)).

The present claims are not directed to subject matter which the public had theretofore freely enjoyed. Until the present invention, the public never enjoyed fullerenes in macroscopic amounts. Based upon the allegations in the cited article, the public would still not be in possession of the claimed subject matter for it is not feasible that macroscopic amounts of fullerenes would be produced from mining those rocks. See Kroto Declaration II, Paragraph 16. Thus, if it weren't for the invention of Huffman and Kratschmer, the public would not have any access to fullerenes in macroscopic amounts.

Accordingly, the claimed subject matter is not directed to a product of nature.

The same conclusion is also applicable to the subject matter relating to substantially pure solid or crystalline or to substantially pure macroscopic amounts of fullerenes. Substantially pure products are not alleged to be naturally found in the cited article. The article alleges that the C_{60} or C_{70} are found in trace amounts. They are reported to be found as a part of a larger geological sample and are thus very impure. See Kroto II Declaration, Paragraph 17. Thus, substantially pure products are man-made.

This issue was decided by the Court In re Bergstrom, cited hereinabove. As the court stated:

> The fundamental error in the board's position, as we see it, is the analysis and answer it gave to the sole issue it accurately posed--"whether the claimed pure materials are novel as compared with the less pure materials of the reference...It seems to us that the answer to that questions self-evident; by definition pure materials are necessarily different from less pure or impure materials and if the latter are the only

> ones existing and available as a standard of reference, so seems to be the situation here, perforce "pure" materials are "new" with respect to them...[Emphasis in original]

Id., 427 F.2d at 1401, 166 USPQ at 262.

Thus, purified naturally occurring products vis a' vis impure product have been held not to come within the purview of 35 U.S.C. §101.

Moreover, there is a question in the scientific community of whether Buseck, et al. actually found any fullerenes. See Kroto II Declaration, Paragraphs 11 and 12 and Exhibit 7 attached. Both Kroto and Gibbesen, et al. obtained shungite rocks, but neither group could reproduce the results, i.e., they did not find any fullerene in the shungite. Thus, there is a controversy regarding the validity of the findings described in the article.

Thus, in conclusion, from the record, it is clear that the natural existence of C_{60} and C_{70} has not been established. Applicants have submitted sufficient evidence which brings into serious questions the conclusions in the cited article. Moreover, even if the teachings in the article are to be accepted, it only alleges that C_{60} and C_{70} are found in minute quantities. The teachings in the cited article do not prove that the claimed subject matter does not have all of the requirements for patentability under 35 U.S.C. §101. The present invention takes on a new form, quality, property, or combination thereof that was not present in the cited articles or heretofore. The fact is that the C_{60} and C_{70}, if present in the rocks, are only present in very small amounts that has no practical significance. The C_{60} and C_{70}, if present in the rocks, are completely useless. In fact, if it weren't for the present invention, the presence of C_{60} and C_{70} in the rocks would have gone unnoticed.

On the other hand, the present invention is far removed from the allegation of the infinitesimal presence of C_{60} and C_{70} in the rocks. The present invention is directed to fullerenes that were synthesized, producing these products in amounts that could be seen with the naked eye. The present inventors have made fullerenes in a form that was never available heretofore, as a solid, in macroscopic amounts, in macroscopic amounts that are substantially free from non-fullerene particles. As a result of this invention by Huffman and Kratschmer, the public for the first time has available to it fullerenes for use in amounts that have never been realized heretofore. This discovery revolutionized science and fulfilled a long felt need--evidence of patentability.

The discovery of fullerenes by the present inventors has become for every practical purpose, a new thing, a new form. Even if the allegations in the article are accepted as true, the present discovery has made a useless something that was naturally made into something useful. The claimed subject matter is therefore directed to patentable subject matter within the statutory requirements of 35 U.S.C. §101. Thus, the rejection of the claimed subject matter under 35 U.S.C. §101 is obviated, and withdrawal thereof is respectfully requested.

Inasmuch as Claim 48 has been canceled without prejudice, the rejection under 35 U.S.C. §102(b), and/or 103 has been rendered moot. As amended, none of the claims are directed to colored diamond.

In support of the rejection of the claimed subject matter, under 35 U.S.C. §102(b) or in the alternative under 35 U.S.C. §103(b), the Office Action cites Kroto, et al. The Office Action alleges that this rejection is not applicable if the claims are directed to macroscopic amount of fullerenes.

However, as amended, the claims are directed to macroscopic amounts of fullerene, in one form or another. Kroto, et al. do not teach, disclose or suggest fullerene in macroscopic amounts. This fact is admitted by authors of these article in Scientific American, 1991 pp 54-63. Attention is directed to pg. 54-55, in which they admit that they never produced visible or macroscopic amounts of fullerenes. Therefore, for the reasons provided, the rejection of the claims under 35 U.S.C. §102 and/or 103 is obviated and withdrawal thereof is respectfully requested.

Pursuant to the rejection of claimed subject matter under 35 U.S.C. §102(b), the Office Action cites Kratschmer, et al. I. According to the Office Action, the reference discloses the formation of fullerenes, based upon the alleged identity of the spectra.

Kratschmer, et al., however, do not teach, or disclose that they had in their possession fullerenes. More specifically, they noted strong absorption bands originating from matrix-isolated carbons and they identified them as C_4, C_5, C_6, C_7, C_8 and C_9; thus, it is not evident from the article that they made fullerenes. Moreover, whatever it is they made, Kratschemer, et al. never isolated macroscopic, i.e., visible amounts of same as presently claimed. Therefore, Kratschmer, et al. I do not teach or disclose the claimed subject matter; withdrawal of this rejection is respectfully requested.

In support of the rejection of claimed subject matter under 35 U.S.C. §102(a), the Office Action cites Kratschmer, et al. II. The reference discloses the preparation of C_{60} in carbon soot; however, the reference never separated the C_{60} from the soot, and isolated it. This is unlike the present invention which is directed to isolated fullerenes in macroscopic amounts.

Thus, Kratschmer, et al. II do not teach or disclose the present invention; therefore this rejection is obviated, and withdrawal thereof is respectfully requested.

Inasmuch as the claims of the present application are not in conflict with those of the '246 application, 37 C.F.R. §1.78(b) is not applicable in the present situation.

The Office Action requested applicants to explain why any amendment to the instant claims would lead the Examiner to not join this application with the interference involving USSN 07/580,246. In order to join the action with the interference, there needs to be a determination by the United States Patent and Trademark Office that the subject matter herein defines the same patentable invention as defined in 37 C.F.R. §1.601(n). No such determination has been or could be made in the present case. Moreover, the United States Patent and Trademark Office must also find allowable subject matter in the present application. Since these claims are presented for the first time in this application, the United States Patent and Trademark Office has not had the opportunity to assess these claims.

Instead of joining this application in interference, the United States Patent and Trademark Office has other options available to it. It can continue prosecution, but there is always the possibility that decisions herein may conflict with those made in the interference. However, to avoid this problem, it may be propitious to suspend ex parte prosecution. It is not uncommon to suspend ex parte prosecution in related applications until the interference and/or any appeal therefrom is concluded.

Applicants attorney is receptive to discussing any of the issues discussed herein or raised in the Office Action with

the United States Patent and Trademark Office in order to advance the prosecution of the instant application.

Thus, for the reasons given herein, the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,

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MJC/bb